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IMPACT OF THE DOUGLAS-FIR TUSSOCK MOTH ON FOREST RECREATION IN THE BLUE MOUNTAINS

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IMPACT OF THE DOUGLAS-FIR TUSSOCK MOTH ON FOREST RECREATION IN THE BLUE MOUNTAINS

Reference Abstract

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A survey of recreationists, resort owners, packer-guides, motel operators, and employees of natural resource agencies revealed little evidence that a recent outbreak of Douglas-fir tussock moth had significant or widespread influence on recreation in northeastern Oregon.

KEYWORDS: Douglas-fir tussock moth, *Orgyia pseudotsugata*, recreation, recreation use, insects, insect damage (-forest, Oregon (Blue Mountains), Oregon (northeastern), Blue Mountains--Oregon, northeastern Oregon.

RESEARCH SUMMARY

Research Paper PNW-224

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In this paper, we report impacts of a recent Douglas-fir tussock moth outbreak and subsequent DDT control program on recreationists and private recreation businesses in northeastern Oregon. The decision to apply DDT in 1974 generated considerable controversy that received widespread national as well as local and regional news coverage.

Data were collected in 1975 by on-site interviews with summer recreationists and deer and elk hunters, telephone interviews with persons who had hunted in northeastern Oregon during 1971, 1972, or 1973, owners of private recreation businesses, and personnel with public land-management agencies.

Although the land-management agencies reported numerous inquiries about the tussock moth during the peak of the controversy in 1973 and 1974 and a large proportion of recreationists interviewed had heard about the situation, we found little evidence that the damage or spraying affected recreation businesses or caused any appreciable reduction in recreational participation. Estimates of the short-term impact on recreationists appear to have been exaggerated.

Efforts to inform the public about the tussock moth seem to have been effective and undoubtedly aided interested citizens to obtain additional information if they wanted it. Once the decision to spray had been made and the control program completed, however, the intensity of public interest declined rapidly. The tussock moth and spray program apparently were no longer salient to most recreationists in 1975.

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Introduction

An outbreak of Douglas-fir tussock moth, *Orgyia pseudotsugata* (McDunnough), in eastern Washington, northeastern Oregon, and northern Idaho caused various degrees of damage to trees on 800,000 acres (324 000 ha) over a 4-year period and culminated in a control program of aerial application of DDT (dichlorodiphenyltrichloroethane) in 1974.[1/]

The entire tussock moth issue received national as well as local and regional attention as a result of the controversy generated by the decision to spray with DDT. Although more than 90 percent of the written comments[2/] from persons living in noninfested as well as infested areas of Washington and Oregon supported the application of DDT to control tussock moth, various wildlife and environmental organizations opposed its use.

Benefits from insect control programs should exceed costs incurred in the control effort. But benefits of protecting scenic and recreational resources are difficult to measure in dollars. Furthermore, because some defoliation and tree mortality occur naturally in forests, defining what forest visitors consider unacceptable damage is difficult.[3/]

To influence patterns of recreational behavior, events occurring in the damaged areas had to be perceived by recreationists as likely to interfere with a safe or pleasurable outing. Four distinct factors associated with the tussock moth outbreak, and subsequent management activities could have affected experiences of on-site visitors or influenced others to visit or avoid damaged areas.

- *The presence of insects--especially larvae.* The insects fall on visitors or get into food or clothing, and some persons are allergic to hairs of the tussock moth larvae.

- *Discoloration, defoliation, and mortality of forest vegetation.* The immediate consequence is a change in the appearance of the landscape. In the long run, the potential for physical hazard to forest visitors from falling limbs or fire is increased.

- *Intensified management activities.* DDT spraying, salvage logging, road building, and heavy equipment activity along forest roads may have inconvenienced some visitors and probably increased the chance for accidents along some logging roads, particularly on weekdays. Probably the greatest impact of road construction has been to change recreation

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[1/] Graham, David A., Jack Mounts, and Dewey Almas. 1974. Cooperative Douglas-fir tussock moth control project. USDA Forest Service. Pacific Northwest Region. Portland. 74 p.

[2/] Kelley, Stephen A., and William J. Rompa. 1973. Public opinions about controlling the 1973 Douglas-fir tussock moth outbreak. USDA Forest Service. Pacific Northwest Region. Portland. 27 p.

[3/] USDA Forest Service. 1974. Forest Service-USDA environmental statement, cooperative Douglas-fir tussock moth pest management plan. Pacific Northwest Region. Portland. 355 p.

opportunities for the forest visitor; remote areas, previously accessible only on foot or horseback, can now be entered by automobile or snowmobile.

- *Flow of information about the tussock moth and control measures.* News stories and information passed along by persons who had been in the area may have altered visitors' expectations or influenced their decision to visit damaged areas. For example, news releases in 1974 warned hunters about DDT residues in the fat tissues of game animals.

The tussock moth outbreak and control also might affect public and private organizations such as resorts, motels, and recreation management agencies that supply recreation services. Furthermore, any significant changes in patterns of recreational use would be felt in the economy of nearby communities.

We describe effects of the tussock moth outbreak, DDT spray program, and salvage logging on recreational visitors and on organizations that serve recreationists in four counties of northeastern Oregon. We sought to understand and to measure human response to epidemics of defoliating forest insects.

Methods

Our investigation began in the summer of 1975, 1 year after DDT was sprayed. We began the study on the assumption that the impact of tussock moth and related control actions should still be detectable even though the most immediate and direct influences occurred earlier--in 1973 and 1974, when insect populations were at their peak and the proposed DDT spray program was generating much public interest. To overcome this time-lag problem and to insure that the study would produce an accurate description of how people responded to the outbreak and control action, we collected data from diverse sources by a variety of survey methods.

On-site visitors summer and fall, 1975. Summer recreationists, deer hunters, and elk hunters were interviewed from August through November. Visitors were interviewed at two State parks and at selected campsites and forest roads in the Umatilla and Wallowa-Whitman National Forests. Through a planned sequence of questioning, recreationists were asked: (1) if they had noticed any changes in the Blue Mountains recently; (2) if they had changed their recreation patterns in response to gasoline shortages, economic conditions, declining deer populations, or insect problems; and finally, (3) if they were aware of problems in the area with the Douglas-fir tussock moth or mountain pine beetle.

Previous recreational visitors. The only link that could be established with recreationists who may have avoided damaged areas in 1975 because of the tussock moth--persons who would not be included during the on-site interviewing--was through special elk season hunting lists from the Oregon State Wildlife Commission. Hunters who had special elk permits in 1971, 1972, and 1973, were asked, by telephone, a sequence of questions similar to that in the on-site interviews.

Private firms that supply recreation services. Operators of packing and guide services and resorts in the area, by personal interview and a random sample of motel owners by mailed questionnaire, were asked:

(1) if during recent years customers asked about the availability of gasoline, declining deer populations, mountain pine beetle, or the tussock moth situation; (2) if the operators believed gasoline shortages, declining deer populations, economic conditions, mountain pine beetle, or the tussock moth situation had any impact on their businesses; and (3) if the firms changed their mode or location of operation in response to tussock moth damage in areas important to their businesses.

Owners were also asked to provide data on business volume for 1970-75 comparison with other data collected from public agencies.

Statistics on recreational use from public agencies. Reliable recreational use data for 1970-75 were collected from the Oregon State Parks Department. Forest Service data were incomplete and could not be used because funding for double sampling visits at recreation sites was reduced significantly in Region 6 after 1973.

Interviews with public agency staff. Staff with public agencies such as the Oregon State Parks Branch of the Department of Transportation, U.S. Forest Service, and the Oregon Wildlife Commission were asked to recall the nature and amount of citizen inquiry--by letter, phone, or office visit--that concerned the tussock moth. They were also asked about the extent and cost of cleanup required on recreation sites as a result of tussock moth damage.

Results

ON-SITE VISITOR SURVEY

Field interviews were completed with 780 persons under the following conditions:

	Respondents (Percent)
Interview season	
Summer (Aug. 1-28)	53
Deer season (Oct. 1-9)	21
Elk season (Nov. 1-11)	26
Interview location	
State parks	15
Forest Service campgrounds	36
Along Forest Service roads	49
Time of interview	
Weekend	60
Weekday	40

Characteristics of respondents varied considerably:

Age (Years)	
15-30	23
31-60	67
Over 60	10

Size of party (Persons)	Respondents (Percent)
1	8
2	31
3-7	50
8 or more	11
Composition of party	
Alone	8
Families with children	37
Groups (2 or more)	51
Other	4
Residence	
Local[4/]	55
W. Oregon	28
E. Oregon	4
W. Washington	1
E. Washington	4
Other	8
Familiarity with the area	
First-time visitors	18
Repeat visitors	82
Prior visits to other Blue Mountain areas	
(Number of areas)	
0	18
1-2	41
3-5	13
5	28

Nearly 60 percent of the respondents lived nearby or in other eastern Oregon locations. Eight of 10 had been to the interview site before and had visited other areas of the Blue Mountains as well.

Of the 640 repeat visitors, 73 percent had visited areas where the tussock moth was active during 1972-74 and 45 percent had been in the area before 1972.

Awareness of tussock moth: No direct questions. First-time visitors (N = 115) were asked if any aspects of the Blue Mountains had not lived up to their expectations and if they had read--or heard people talk about--changes in the Blue Mountains. Respondents mentioned road problems, seeing too many people, and changes in recreation sites and facilities. Only two persons (2 percent) mentioned the Douglas-fir tussock moth.

[4/] Includes these counties: Idaho - Lewis, NezPerce, Payette, Washington; Oregon - Baker, Umatilla, Union, Wallowa; Washington - Asotin, Columbia, Garfield, Walla Walla.

Repeat visitors (N = 640) were asked if they had noticed any major changes since they had been coming to the Blue Mountains. Eighty percent said they had observed changes, as follows:

Changes mentioned	Directly observed changes	Read or heard about changes	Total
	(Percent)	(Percent)	(Percent)
Roads	38	2	40
Campsite and facilities	34	3	37
People in the area	22	1	23
Tussock moth	7	2	9
Other insects	1	<1	1
Other	16	2	18

Overall, without any direct probing about insect problems or tussock moth, 9 percent of the repeat visitors (N = 640) said that they had directly observed or read or heard about changes in the Blue Mountains they thought were caused by the Douglas-fir tussock moth.

All of the respondents (N = 780) were asked if changes or events over the last 2 or 3 years had influenced their decision to visit the Blue Mountains. Twenty-nine percent said yes:

Change or event	Respondents	
	(Percent)	
Roads	2	
Campsites and recreation facilities	2	
Gasoline (price or availability)	1	
People in the area	1	
Douglas-fir tussock moth	1	(7 people)
Various other comments	22	
No influence	71	

Of the seven who changed plans because of the tussock moth, one went to a different area in the Blue Mountains, another cancelled the trip, and one was said to have become sick because of dust from the logging of moth-killed trees. The other four did not specifically explain how their plans changed.

Awareness of tussock moth: Direct questions. After indirect questioning, the interviewers asked if gasoline shortages, inflation in the economy, or insect problems in the Blue Mountains affected respondents' recreational activities. Of the 697 people who were asked the question, 208 mentioned the tussock moth and 30 said they stayed out of the area because of it. The other responses related to the tussock moth concerned visual changes, DDT spraying (no one reported avoiding areas sprayed with DDT), and skin irritations.

On August 13, halfway through the summer interview period, the questionnaire was modified so that after the indirect questioning about insects, the interviewer asked the respondents directly if they had heard of the tussock moth situation. Table 1 summarizes the awareness of different groups of the respondents.

Table 1--*Awareness of the tussock moth situation by persons interviewed after August 12*

Item	Sample size	Knowledge of tussock moth			
		Without direct questions	When asked about insect problems	When asked about tussock moth	No knowledge of tussock moth
	Number	Percent			
Category of visitor					
All respondents	580	9	26	49	16
First-time	65	2	20	46	32
Repeat	515	10	26	50	14
Summer	212	10	45	15	30
Deer season	162	9	13	69	9
Elk season	206	7	16	71	6
Activity					
Hunting	305	6	14	72	8
Gathering forest products	87	13	32	38	17
Fishing	79	15	29	33	23
Hiking	74	12	22	50	16
General	240	7	28	46	19
Friends	13	8	31	46	15
Travel	79	9	38	34	19
Sports	42	7	31	41	21
Others	62	10	24	55	11
Residence					
Local	305	10	31	43	16
Oregon (other than local)	219	7	16	67	10
Washington	26	4	31	34	31
Other (all other States)	27	7	41	15	37
Avoided infested areas	580	<1	4	2	--

Overall, less than 1 person in 10 mentioned tussock moth problems when questioned about changes in the area or events that influenced recreational travel plans in the Blue Mountains. When asked specifically about the tussock moth, 16 percent of the respondents said they were not aware of problems in the area. The percentages for all respondents combined can be misleading, however; differences in awareness by season of interview and by characteristics of respondents are important.[5/]

Thirty percent of the summer visitors were unaware of the tussock moth situation--a much greater proportion than deer and elk season visitors (9 and 6 percent, respectively).

A higher proportion of fishermen, hikers, and gatherers of forest products such as berries mentioned the tussock moth before direct probing by interviewers. A higher proportion of those in the "Others" activities category--mostly workers in the area--as well as deer and elk hunters, mentioned tussock moth as the result of direct probing. Only 10 percent of the local visitors mentioned tussock moth before direct questions about insects or the tussock moth.

Although the tussock moth related events of 1972, 1973, and 1974 generated considerable controversy locally as well as elsewhere in the Northwest, these events apparently were no longer salient to most on-site visitors interviewed in 1975.

Impact of the tussock moth on recreation activity. With the questionnaire as modified after August 12, 580 recreationists were interviewed. Less than 1 percent indicated--before directly questioned

[5/] Percentages for the degree of awareness of the "All respondents" category varies depending on the proportion of different subgroups in the sample; for example, the proportion of summer visitors to deer- and elk- season visitors.

about it by the interviewer--that they had stayed away from tussock moth areas. Four percent said they avoided the tussock moth when the interviewer asked about insect problems. Of those asked specifically about tussock moth, only 2 percent said they avoided damaged areas. We could not determine if visitors stayed away because the moth was active or because areas had been sprayed with DDT.

TELEPHONE SURVEY

A disproportionate stratified sample of special elk season permits for 1971, 1972, and 1973 was selected; and the hunters were telephoned:

Residence	Permits on 1971-73 lists		Hunters interviewed	
	(Number)	(Percent)	(Number)	(Percent)
Local	82	10	33	29
E. Oregon	188	24	39	34
W. Oregon	514	66	42	37
	784	100	114	100

Ninety-six percent of those telephoned had hunted in the Blue Mountains before 1973. No significant differences by home location were found. Proportionately more local respondents, however, hunted and participated in other recreation activities in the area in 1973 or 1974:

Residence	Respondents	Recreation in 1973 or 1974	
		Hunting	Other
	(Number)	(Percent)	(Percent)
Local	33	94	82
E. Oregon	39	77	46
W. Oregon	42	71	36

Respondents were asked two questions to probe for their awareness of the tussock moth situation: (1) had they personally noticed any changes or problems and (2) had they read or heard about changes or problems?

Type of change	Changes observed directly (Total responses, 211)	Changes read or heard about (Total responses, 127)
	(Percent)	(Percent)
People	22	10
Roads	19	16
Game management	18	17
Administration	10	20
Logging	10	14
Road closure	8	14
Tussock moth	6	9
DDT	3	--
Scenery	4	--
	100	100

Significant variation (at the 0.05 level of probability) in the proportion of responses by home location occurred for only one item. Seventeen percent of the western Oregon residents and 18 percent from eastern Oregon mentioned reading or hearing about tussock moth compared with only 3 percent from the local area.

The respondents were asked specifically about factors that may have influenced their decision to avoid the Blue or Wallowa Mountains in recent years:

Factor	All respondents N = 114 (Percent)	Local N = 33 (Percent)	E. Oregon N = 39 (Percent)	W. Oregon N = 42 (Percent)
Game population	39	42	38	36
Inflation or cost of living	23	30	23	17
Douglas-fir tussock moth	18	30	15	10
Gasoline shortages	15	12	18	17
DDT spraying	4	6	3	2
Mountain pine beetle	4	9	5	0

Avoidance of areas infested with tussock moth was significantly greater for local residents. Although 23 hunters said the infestation or DDT spraying influenced their decision not to go to the area, 14 (61 percent) did hunt in the Blue or Wallowa Mountains in 1973 and 22 (96 percent) hunted there during 1973 or 1974. Most, however, said they changed hunting locations, presumably to areas with less evidence of damage or where no spraying had occurred.

Based on the 114 hunters sampled, an estimated 15 percent of the 784 hunters who had special elk season permits may have decided not to visit damaged areas because of the infestation or DDT spraying. This compares with about 7 percent of the on-site survey respondents and 5 percent of the on-site elk hunters, who said they avoided areas damaged by tussock moth or sprayed with DDT.

The discrepancy between the on-site interviews and the telephone surveys (particularly between the elk hunting groups) cannot be explained with certainty. However, the question in the telephone survey on factors that may have influenced respondents' decisions to avoid the Blue or Wallowa Mountains at some time was much more specific than the on-site survey questions.

SURVEY OF PRIVATE FIRMS

For information on how tussock moth affected their businesses, we questioned 62 private firms:

Type	Estimated firms in Northeastern Oregon[6/]	Surveys	Method
	(Number)	(Number)	
Packer-guides	19	12	In person
Resorts	13	12	In person
Motels	65	38	By mail

Inquiries about the tussock moth situation. Operators of the firms were asked if they had received inquiries about the tussock moth situation from their clients. They were also asked about inquiries on game populations, availability of gasoline, and the mountain pine beetle, as well as the DDT spraying and salvage logging associated with the tussock moth outbreak (table 2).

Table 2--*Inquiries to businesses by clients about possible influences on recreation*

External factors	Business	Inquiries										Total responses[1/]
		Many		Moderate		Some		Few		None		
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Game population	Resort	4	40	2	20	1	10	2	20	1	10	10
	Packer-guide	10	83	2	17	0	0	0	0	0	0	12
	Motel	6	16	7	19	9	24	9	24	6	16	37
Gasoline	Resort	3	30	2	20	3	30	2	20	0	0	10
	Packer-guide	2	17	3	25	2	17	4	33	1	8	12
	Motel	1	3	5	14	7	19	12	32	12	32	37
Tussock moth	Resort	3	30	2	20	3	30	1	10	1	10	10
	Packer-guide	6	50	2	17	2	17	2	17	0	0	12
	Motel	2	5	0	0	3	8	7	18	26	68	38
OOT	Resort	1	10	2	20	2	20	2	20	3	30	10
	Packer-guide	5	42	2	17	1	8	3	25	1	8	12
	Motel	3	8	1	3	2	5	6	16	26	68	38
Mountain pine beetle	Resort	0	0	1	10	2	20	1	10	6	60	10
	Packer-guide	0	0	1	8	1	8	0	0	10	83	12
	Motel	0	0	0	0	1	3	2	6	28	90	31
Logging	Resort	0	0	0	0	1	11	3	33	5	56	9
	Packer-guide	1	10	1	10	1	10	3	30	4	40	10
	Motel	2	6	4	11	3	8	5	14	22	61	36

[1/] Sample size: Resorts 12, packer-guides 12, motels 38. Sum of percentages in each row may not total 100 because of rounding.

Nearly all of the packer-guide and resort operators said they had received inquiries about the tussock moth and DDT spraying. However, just over half reported inquiries about salvage logging. About one-third of the motel operators reported inquiries about tussock moth and DDT spraying.

The operators' views of the impact these activities had on their businesses are summarized (table 3). Overall, many believe game populations and gasoline problems influenced their businesses more than tussock moth, DDT spraying, or logging. One packer-guide cancelled his 1975 operations because salvage logging roads had been built into his usual hunting area. Another believed that personnel associated with the control operations filled local motels so that recreation visitors could not stay in the area to take advantage of his services.

[6/] Counties include Baker, Umatilla, Union, and Wallowa.

Table 3--*Responses of firms to questions about influences on business*

Subject of inquiry	Business	Influences						Total responses[1/]
		Negative		Positive		None		
		Number	Percent	Number	Percent	Number	Percent	Number
Game population	Resort	4	36	0	0	7	64	11
	Packer-guide	5	42	4	33	3	25	12
	Motel	1	3	20	59	13	38	34
Gasoline	Resort	7	70	0	0	3	30	10
	Packer-guide	5	42	0	0	7	58	12
	Motel	9	28	6	19	17	53	32
Tussock moth	Resort	0	0	0	0	10	100	10
	Packer-guide	0	0	0	0	12	100	12
	Motel	2	6	2	6	28	88	32
OOT	Resort	0	0	0	0	11	100	11
	Packer-guide	1	8	0	0	11	92	12
	Motel	2	6	2	6	29	88	33
Mountain pine beetle	Resort	0	0	0	0	11	100	11
	Packer-guide	0	0	0	0	12	100	12
	Motel	1	3	0	0	31	97	32
Logging	Resort	0	0	0	0	11	100	11
	Packer-guide	1	8	0	0	11	92	12
	Motel	0	0	8	25	24	75	32

[1/] Sample size: Resorts 12, packer-guides 12, motels 38. Sum of percentages in each row may not total 100 because of rounding.

Shifts in areas used. Resort owners and packer-guides were asked if they had shifted areas of primary use because of the tussock moth. Other than the one guide who cancelled his 1975 operations, no shifts in area caused by the tussock moth were reported. Two resorts reported changes because of deer and elk. Five packer-guides reported shifts: one to move closer to home; another to use a wilderness area; and three, within the wilderness area, to avoid concentrations of people.

The operators were also asked if they were aware of any visitors who tried to avoid tussock moth areas (table 4). Two respondents reported that some visitors made a special effort to see tussock moth damage.

Table 4--*Responses by businesses to the question: "Did visitors try to avoid tussock moth areas?"*

Business	"No"		"Yes"		"I don't know"		Total responses[1/]
	Number	Percent	Number	Percent	Number	Percent	Number
Resort	3	25	1	8	8	67	12
Packer-guide	8	67	1	8	3	25	12
Motel	11	32	2	6	21	62	34

[1/] Sample size: Resorts 12, packer-guides 12, motels 38.

Changes in business volume. Adjusted gross income figures for packer-guides and resorts and motel occupancy are shown in figures 1-3. Number of visitors to all Oregon State parks and to northeastern Oregon State parks have been included for comparison. No evidence

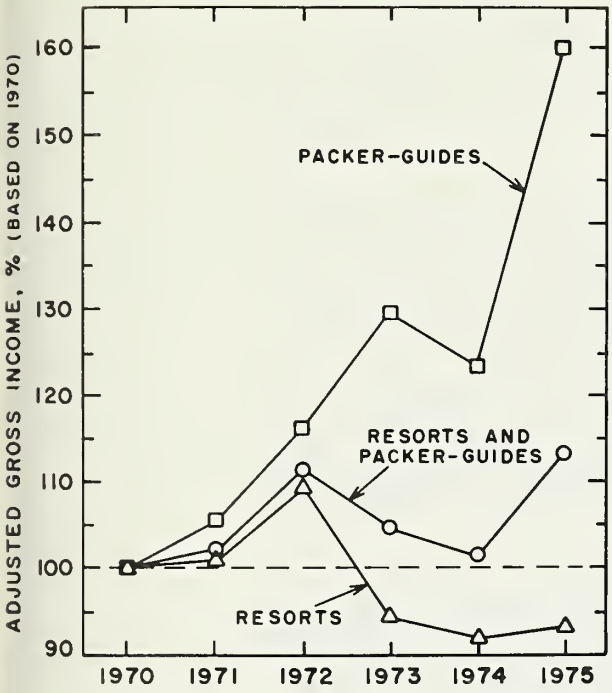

Figure 1.--Adjusted gross income as a percentage of 1970 gross income for 19 businesses in northeastern Oregon (9 packer-guides and 10 resorts).

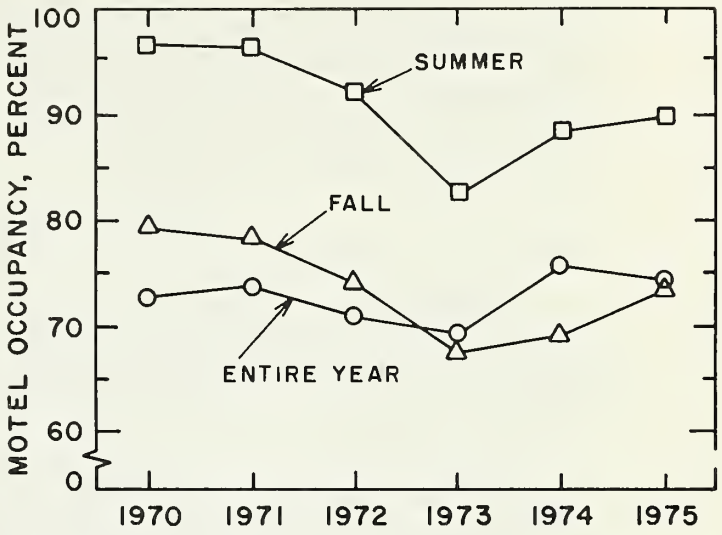

Figure 2.--Average occupancy for motels in northeastern Oregon.

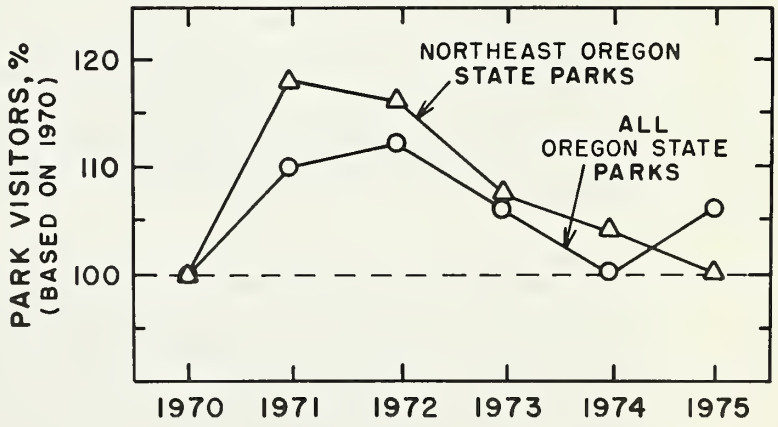

Figure 3.--Number of visitors to Oregon State parks as a percentage of visitors in 1970.

indicates that the tussock moth or related events caused any of the business decline coincidental with the tussock moth infestation. Regression analysis using dummy variables to designate the years when the tussock moth was active and to indicate the proximity of the individual businesses to the tussock moth damaged areas did not support the hypothesis that the decrease in visitors or gross income was related to the tussock moth situation.

PUBLIC INQUIRY OF MANAGEMENT AGENCIES

We interviewed 14 employees from U.S. Forest Service Ranger Districts, Oregon State Parks Branch, and an office of the Oregon Department of Fish and Wildlife, working in the area at the time of the outbreak, concerning public inquiries about the tussock moth and related problems.

Kinds and frequency of questions. The agencies began receiving inquiries in 1973, although two offices received none until 1974. The most frequent type of contact with the public was a personal visit to the office by those seeking information. We do not know if the visits were specifically for information about the tussock moth or for some other purpose and the tussock moth was of secondary concern. Few inquiries were made by letter. Two Ranger Districts reported as many as two telephone calls a day during the height of the infestation, and the Department of Fish and Wildlife at La Grande estimated about a 100 calls before the spraying and 150 to 200 calls between the end of the spraying and the end of the fall hunting season in 1974. No inquiries were reported in 1975.

Inquiries or concerns voiced by the public are listed below in order of the frequency mentioned to the public employees we interviewed: (1) location of spraying and concern for DDT on mushrooms, berries, and in game animals; (2) concern about avoiding the moth and allergy reactions (primarily by wood gatherers); (3) general concern about the tussock moth situation; and (4) concern about wildlife habitat.

One State park reported telephone calls to ask if the park had been damaged and later to inquire if it had been sprayed.

Campground cleanup. Employees of the Forest Service Ranger Districts were asked about the extent of damage to campgrounds and if salvage or removal of dead and damaged trees was necessary. One campground was salvage logged; no other cleanup activities were reported.

The manager of Emigrant Springs State Park and the Blue Mountain Forest Wayside was also called about cleanup activities required because of the tussock moth. The Blue Mountain Forest Wayside was heavily damaged, and the trees were removed for firewood in the State parks. Cost of tree removal was charged to the firewood account, so we could not determine what additional expense was incurred for cleanup after the tussock moth. Emigrant Springs State Park was sprayed twice to prevent tussock moth damage, and it received little.

Emigrant Springs showed a decrease in the number of visitors

beginning in 1972 and reached a low point in 1974; use in 1975 increased slightly. The manager attributed the decline to the completion of a rest area on the interstate highway west of the park; visitors with pickup or trailer campers spent the night in the rest area rather than in the State park. He also believed that the gasoline shortage caused part of the decrease by reducing travel.

Discussion

A diversity of recreation users and private firms as well as personnel with natural resource agencies were questioned during the surveys. Many of the recreation users had prior knowledge of the tussock moth activity. Only about 7 percent of the on-site respondents, however, said they stayed out of affected areas on recreation trips. This was for only a short period as the visitors were back in the areas in 1975. Fifteen percent of the special elk season hunters avoided infested and sprayed areas (as compared with 5 percent of the elk hunters questioned during the on-site interviews). This discrepancy is likely because of differences in the phrasing of survey questions. On-site responses probably underestimated the short-term avoidance that occurred--particularly for elk hunters.

Private firms, including packer-guides, resorts, and motels, had numerous inquiries about the tussock moth, but only about 4 percent (two motels) thought the moth activity had directly harmed their business volume. One packer-guide did not operate in 1975 because of areas opened by roads.

We found no evidence of widespread reduction in business volume because of the tussock moth, based on an analysis of firms' financial records. In fact, several motel operators believed the infestation, DDT spraying, and logging increased their business, although this could not be directly measured from their records.

Conclusions

The most significant events of the tussock moth infestation that affected the general public probably occurred: (1) when the insects were actively annoying visitors and discoloring forest vegetation and, (2) when news coverage of the controversy over use of DDT was at its peak in 1973 and 1974. These were intense, yet short-term events that distressed local residents and other concerned citizens and generated considerable confusion and controversy for natural resource managers.

The actual recreation-related dislocations during this period do not appear to be great or widespread. We could find little or no significant relation between moth damage and recreation. At most, a few people, after reading or hearing about annoyances to some recreationists, temporarily shifted their activities to areas where they would not be bothered by the insects or come in contact with DDT residues. We doubt that any significant reduction in the total amount of recreation participation in northeastern Oregon resulted from the tussock moth.

There may be important long-term effects, however. One of the most significant is associated with building roads (or at least accelerating the rate at which roads are built) for salvage logging of damaged timber. This impact on recreation was mentioned by only one packer-guide, although many recreationists--particularly repeat visitors--commented on the road expansion. Road building increases opportunities for those who seek recreation on dispersed roads, but at the expense of those who favor more primitive, backcountry hunting and hiking.

Long-term impacts on recreation, as well as more immediate effects, of natural events like the tussock moth infestation should be included in evaluations of alternative management programs. Where public involvement on the issues will be solicited, potential impacts of this type should be part of the information available to citizens. Clearly, many of those interviewed in this study, including first-time visitors, had some prior knowledge of the tussock moth. Their awareness was influenced not only by their own experiences and information passed on by others, but also by the public information efforts of natural resource agencies.

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KEYWORDS: Douglas-fir tussock moth, *Orgyia pseudotsugata*, recreation, recreation use, insects, insect damage (-forest, Oregon (Blue Mountains), Oregon (northeastern), Blue Mountains--Oregon, northeastern Oregon.

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